

LOCATIONS OF ACCESSORY PATHWAYS AND VECTORCARDIOGRAMS

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SUMMARY

We have studied the correlations between vectorcardiograms and surgically proved locations of accessory pathways in the Wolff-Parkinson-White syndrome. We have categorized the locations of accessory pathways into eight groups. The sequence of the directions of the initial 20 msec QRS vectors of LA, LL, LP and LPS appeared in ascending order in the left anterior quadrant. Initial 20 msec QRS vectors of RA and RL were directed anteriorly and horizontally, while that of RP was directed horizontally to the left, and that of RPS was directed posteriorly and superiorly to the left. The maximum QRS vectors of LA, LL, LP and LPS were directed in ascending order in the left anterior quadrant. The maximum QRS vectors of RA, RL, RP and RPS were directed in ascending order in the left posterior quadrant. In those cases in which the duration of the QRS complex was 140 msec or more, the maximum T vectors of the left cardiac groups were posterior and those of the right cardiac groups were anterior. The maximum T vector of LL was the furthest left of the left cardiac groups.

INTRODUCTION

On the subject of the locations of accessory pathways of the Wolff-Parkinson-White syndrome, there have been reports based on electrocardiogram or vectorcardiogram by Rosenbaum et al.¹⁾, Boineau et al.²⁾, Frank³⁾ and Tonkin et al.⁴⁾. Now that we have evidence from many more surgical cases, it has become possible to classify more precisely the locations of accessory pathways.

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METHODS

Of the 151 patients on whom we operated at Kanazawa University hospital between 1973 and October 1983, 51 of them fulfilled the criteria for our study. Subjects who had multiple accessory pathways, or had atrial fibrillations with large f waves, or had strongly superimposed delta waves over the P waves were excluded. We were left with 34 males and 17 females, the oldest being 70 and the youngest one year old. The average age was 38. There were 4 subjects below the age of 10. The locations of accessory pathways were determined by intra-operative epicardial mappings. Five accessory pathways were found in the left anterior ventricular wall, hereinafter referred to as "LA", 18 in the left lateral ventricular wall (LL), 7 in the left posterior ventricular wall (LP), and 2 in the left posterior septum (LPS). One accessory pathway was found in the right anterior ventricular wall (RA), 12 in the right lateral ventricular wall (RL), 3 in the right posterior ventricular wall (RP), and 3 in the right posterior septum (RPS). In the vectorcardiograms, we assumed that an amplitude of 0.05 mV marked the origin. All data were analyzed using the t-test.

RESULTS

The average width of QRS complexes was 145 msec in patients of 10 years and above, and 105 msec in patients less than 10 years old. Fig. 1 shows the directions and amplitudes of initial 20 msec QRS vectors from each group. In left cardiac groups (in the upper half), the initial 20 msec QRS vectors were directed anteriorly and the sensitivity was 100%. In the sagittal plane, the directions were $115^{\circ} \pm 18^{\circ}$ in LA, $134^{\circ} \pm 11^{\circ}$ in LL, $174^{\circ} \pm 21^{\circ}$ in LP and $-172^{\circ} \pm 2^{\circ}$ in LPS, so that this sequence appears in ascending order. The differences between LA or LL and LP or LPS were statistically significant. The lower half of fig. 1 shows right cardiac groups. In the horizontal plane, the initial 20 msec QRS vectors were 95° in RA, $90^{\circ} \pm 18^{\circ}$ in RL, $2^{\circ} \pm 16^{\circ}$ in RP and $-24^{\circ} \pm 28^{\circ}$ in RPS, and the vectors were directed horizontally in RA, RL and RP but superiorly in RPS at $-17^{\circ} \pm 11^{\circ}$ in the frontal plane. The differences between RL and RP or RPS were statistically significant.

Fig. 2 shows the directions of the maximum QRS vectors from each group. The maximum QRS vectors were directed anteriorly in the left cardiac groups and posteriorly in the right cardiac groups. The sensitivity and specificity were both 100%. In the left sagittal plane, the average directions of the maximum QRS vectors of the left cardiac groups were $139^{\circ} \pm 25^{\circ}$ in LA, $156^{\circ} \pm 21^{\circ}$ in LL, $174^{\circ} \pm 25^{\circ}$ in LP and $-144^{\circ} \pm 9^{\circ}$ in LPS, so that this sequence appears in ascending order. The differences between

LA or LL and LP and that between LP and LPS were statistically significant. The average directions of the maximum QRS vectors of the frontal plane of the right cardiac groups were 48° in RA, $8^\circ \pm 14^\circ$ in RL, $-17^\circ \pm 11^\circ$ in RP and $-32^\circ \pm 12^\circ$ in RPS, so that this sequence appeared in ascending order. The differences between RL or RP and RPS were statistically significant.

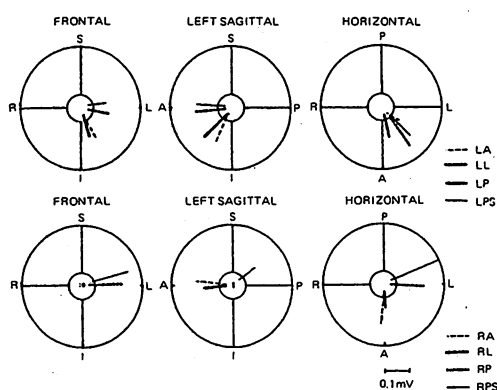


Fig. 1 Initial 20 msec QRS vectors

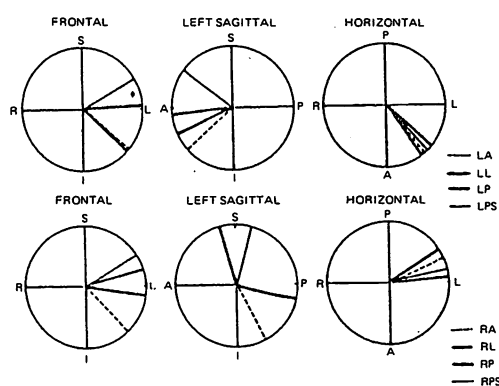


Fig. 2 Maximum QRS vectors

As for the T loops, we excluded those cases in which the duration of the QRS complex was shorter than 140 msec. The average directions of the maximum T vectors of the left cardiac groups were posterior. The sensitivity was 69% and the specificity was 100%. The average direction of the maximum T vector of LL was $-23^\circ \pm 46^\circ$ in the horizontal plane, further left than the other left cardiac groups. In the right cardiac groups, the average directions of the maximum T vectors were anterior. The sensitivity was 100% and the specificity was 69%.

DISCUSSION

There have been reports by Boineau et al.²⁾, Frank³⁾ and Gallagher et al.⁵⁾, concerning surgically proved locations of accessory pathways and their correlation with electrocardiograms in the Wolff-Parkinson-White syndrome. But these reports were based on evidence from only a small number of patients or did not show clear differences between the groups. Tonkin et al.⁵⁾ were able to differentiate paraseptal groups from free wall group by initial QRS vectors from vectorcardiograms.

We have operated 151 patients of the Wolff-Parkinson-White syndrome. Out of them, 51 patients fulfilled our criteria and had relatively long durations of QRS complexes. We excluded those subjects who had multiple accessory pathways, or had

atrial fibrillations with large f waves or had strongly superimposed delta waves over the P waves. We investigated initial 20 msec QRS vectors, maximum QRS vectors and maximum T vectors, and we conclude that the findings of vectorcardiograms correlate closely with the locations of the accessory pathways which were determined by intra-operative epicardial mappings.

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